A STUDY OF ONE THOUSAND OPERATIONS FOR ACUTE INTESTINAL OBSTRUCTION AND GANGRENOUS HERNIA.[1]

By CHARLES LANGDON GIBSON, M.D.,

OF NEW YORK,

SURGEON TO ST. LUKE'S AND TO THE CITY HOSPITALS.

(CONCLUDED FROM PAGE 514.)

FEMORAL HERNIA.

ONE hundred and eighty-eight cases; died, 69; mortality, 37 per cent.

Males, 30; died, 10; mortality, 33 per cent.

Females, 154; died, 58; mortality, 38 per cent.

Ratio, males to females, 1 to 5.

Right side, males, 16; females, 85.

Left side, males, 9; females, 47.

It is evident that:

(1) More femoral herniæ are seen in a gangrenous condition than the usual ratio of inguinal hernia.

(2) That the ratio of the usual frequency of distribution of hernia in the two sexes is entirely reversed.

(3) That the ordinary distribution of the two kinds of "groin" herniæ in women, which is approximately as 1 is to 1, is changed to fifteen times as frequent when the femoral herniæ of women become gangrenous.

The chief reasons for the greater liability to accidents of femoral herniæ, the writer believes, are that:

(*a*) Ordinarily (till a mishap supervenes) a femoral hernia, supported or not, gives less trouble than an inguinal, is less under observation, and is therefore given less consideration and watchfulness, thereby not so soon calling attention to accidents of strangulation.

---

[1] Read before the New York Surgical Society, May 9, 1900.

(*b*) Accidents of strangulation, owing to the anatomical conditions, are less readily overcome by the patient, and deception as to the accomplishment of relief by taxis even in skilled hands is also more frequent.

(*c*) Strangulation once set up, from the unyielding nature and narrowness of the canal, destructive changes are more certainly and quickly produced.

(*d*) Not infrequently the first appearance of a femoral hernia is coincident with its strangulation.

UMBILICAL AND VENTRAL HERNIA.

Twenty-two umbilical, 2 ventral; died, 16; mortality, 67 per cent.

Males, 3; females, 20.

Resection, 16; died, 10.

Resection and artificial anus, 3; died, 1.

Artificial anus, 2; died, 0.

Various, 3.

This form of hernia is particularly severe in its consequences. The patients are usually of the stout, flabby type, with little resisting force. Even the operation of radical cure of the non-strangulated form of this variety of hernia is attended with a considerable mortality. By many, and the writer thinks wisely, its performance is only indicated in the presence of disabling or increasing symptoms, or failure of mechanical support to give proper relief. The class of patients is therefore a most important factor in the mortality of the operation.

The operation is apt to be attended with great technical difficulties, separation of adhesions, etc., and very large portions of intestine may have to be removed.

One operator[17] had to remove 466 centimetres of small intestine; on post-mortem, what little remained of the small intestine was found to be also gangrenous; in other words, he had not performed a sufficiently radical operation.

One resection of 225 centimetres[17] was also fatal, but one[18] of 186 centimetres was successful. Two of these operations were in the course of pregnancy, one patient surviving.

OBTURATOR HERNIA.

Seven cases; died, 6; mortality, 86 per cent.

Five were treated by laparotomy, of which two were simply reduced, both dying from gangrene of the gut.

Three resections, one cure; three artificial anus, all died.

This form of hernia is apt to be overlooked, and pursues the ordinary course of a supposed intestinal obstruction. The constriction is very marked, and the most drastic remedial measures are usually necessary. In one operation the time is given as three hours,—almost necessarily fatal, *per se*.

TABLE IX.

RESULTS OF THREE HUNDRED AND FIFTY-FOUR OPERATIONS FOR GANGRENOUS HERNIA.

DAYS OF OBSTRUCTION.	RESECTION, WITH IMMEDIATE REUNION OF INTESTINE.			RESECTION, WITH ARTIFICIAL ANUS OR ENDS OF INTESTINE.		ARTIFICIAL ANUS.		INVAGINATION OF GANGRENOUS PORTION.		ENTERO-ANASTOMOSES, ETC.		Total	Died.	Mortality, per cent.
	No. of Cases.	Deaths.	Mortality, per cent.	No. of Cases.	Deaths.	No. of Cases.	Deaths.	No. of Cases.	Deaths.	No. of Cases.	Deaths.			
1	9	0	0	0	0	0	0	3	0	.	. .	12	0	0
2	35	3	9	4	4	13	5	4	0	2	1	59	14	24
3	41	10	24	9	2	12	8	4	1	2	2	68	23	34
4	33	9	27	3	1	9	6	2	1	Three unclassified operations to be added: second day, 1; eighth day, 2. All fatal.		47	17	36
5	23	7	30	6	4	9	5	2	0			40	16	40
6	17	8	47	0	0	6	4	2	1			25	13	52
7	7	2		0	0	2	0	0	0			9	2	. .
8	13	4		2	1	7	3	0	0			24	10	. .
9	2	1		0	0	4	4	0	0			6	5	. .
10	6	3		2	1	1	0	1	0			10	4	. .
11	2	0		1	1	0	0	0	0			3	1	. .
12	1	0		0	0	1	0	0	0			2	0	. .
13	0	0		1	1	0	0	0	0			1	1	
14	1	0		0	0	1	1	0	0			2	1	. .
Third week .	2	1		1	0	1	1	0	0			4	2	. .
Fourth week	0	0		0	0	1	0	0	0			1	0	. .
Not stated .	34	10		1	0	4	1	2	0			41	11	. .
Total . .	226	58		30	15	71	38	20	3	7	6	354	120	. .
Mortality . .	26 per cent.			50 per ct.		53 per ct.		14 per ct.		. . . .		34 per cent.		. .

Results of Treatment of Gangrenous Hernia.

These figures (Table IX) demonstrate a marked superiority of resection and primary enterorrhaphy over artificial anus, with or without resection of the gangrenous intestine. They are, the writer believes, the first *large* collection of carefully selected cases occurring in *recent* years. It is freely conceded that statistics derived from the literature are much better than the results of actual practice; but it must be borne in mind that these statistics are largely drawn from extensive reports of individual operators and clinics. and that the cases of artificial anus have been tabulated hand in hand with the cases of resection. Moreover, the writer has classed, and he believes properly so, as fatal such cases of artificial anus as made a good recovery, but succumbed to secondary operations for the reunion of the gut.

The factors influencing the better results of treatment of gangrenous hernia over that of intestinal obstruction may be expressed as follows:

(*a*) Limitation of the septic process,—plastic peritonitis obliterating the general cavity. Such an event does not invariably occur; but it is the greatest factor in the result. The surgeon cannot do better than to accept Nature's hint and assistance, and, whenever applicable, seek to convert his intraperitoneal work into extraperitoneal by excluding suspicious gut or doubtful anastomoses from the general cavity by intelligently applied temporary packing.

(*b*) Operative indications are simplified, that is, the surgeon has the diseased conditions plainly in sight, and need waste no time in preliminary procedures.

(*c*) Operative technique is simplified, the operation being done outside of the abdominal cavity.

(*d*) Herniæ come to operation on an average earlier than do cases of obstruction; in this instance, the contrast is not so important, as the question of dosage of absorption in proportion to the duration of obstruction is naturally modified by the protected position of the hernia. A careful computation of these cases shows, however, that at the time of operation, obstruction will have existed in hernia, on an average, 101.28 hours: in intestinal obstruction, 115.92 hours, or as 7 is to 8.

That in these modern days a hernia should not come to operation till on the average more than four days have elapsed, shows that there is still much missionary work to be done.

The present array of statistics is much more favorable to results of operations for gangrenous hernia than has ever been published.

Mr. Kendal Frank's[27] series of 227 resections prior to 1893 (beginning with Ramdohr in 1727) makes a most interesting comparison with the present series of 226 since 1887, the mortality of the earlier being 47 per cent.

Zeidler's[15] statistics, published in 1892, are also worthy of comparison.

Resections for gangrenous hernia, 289; died, 142; mortality, 49.13 per cent.

Artificial anus for gangrenous hernia, 287; died, 213; mortality, 74.22 per cent.

It is perfectly fair, the writer believes, to ascribe the improved statistics of primary resection (mortality, 26 per cent.), and its superiority over artificial anus, to improved technique, and especially to the greater familiarity with such particular technique by operators in general.

The value of mechanical aids in making these improved results possible must not be underestimated. Of these the Murphy button, even with its acknowledged drawbacks, is undoubtedly the best, and has so far not yet yielded to any other, although probably no mechanical device ever introduced into surgical practice has produced so great a stimulus towards its improvement or displacement. Many of the early objectors have been entirely won over; and even if other endorsements were lacking, the unreserved approval of it expressed by Czerny, than whom no one living is better qualified to pass judgment in questions of intestinal surgery, would alone suffice to maintain it in its proper position. It is certainly the best means of reuniting the intestine in the hands of an operator lacking a large experience with enterorrhaphy.

Primary enterorrhaphy with the Murphy button for gangrenous hernia was performed sixty-three times with fourteen deaths, a mortality of 22 per cent. Such a favorable showing for so serious a condition has never been approached, the writer believes; and even allowing for "literary" results,—necessarily optimistic,—must be accepted in all seriousness as evidence of a vast improvement in method.

The portion of the intestine resected is nearly always the small intestine, although many operators speak of "intestine." The cæcum was excised four times,—twice as part of the ileocæcal coil, and a portion of the transverse colon once.

The following herniæ required resections of a metre or more (centimetres), 466, 310 (cured), 225, 186, 151, 108. Usually the length removed is noted as pretty small; better results would probably be obtained by erring on the side of generosity in all doubtful cases.

The results of resection in the first few days (see Table IX) show most beautifully the necessity of early operations, and the admirable results obtainable by it. Other tables, such as those of intussusception, show the good results obtained by early operations, chiefly by emphasizing the good or bad condition of the gut, according as interference is early or late. In comparing the results of operations for gangrenous hernia by the standard of the duration of the obstruction, we get a more accurate gauge of the constitutional effects on the patient, as we have a standard condition in all cases,—gangrene of the intestine.

Attention, therefore, is particularly called to the absence of mortality on the first day with nine resections; only three deaths out of thirty-five cases on the second day; then a jump to 24 per cent. on the third day, and progressing steadily till the sixth day, with 47 per cent. Other days should not be worked out on account of the dangerous fallacies of small figures.

Resection without enterorrhaphy,—*i.e.*, artificial anus of the ends, 30 cases; 15 deaths; 50 per cent.

This is a very good procedure, which should be more frequently employed; in fact, if there are no great technical counterindications,—and such must be infrequent,—it is hard to understand why it should not be the ideal method of establishing an artificial anus in gangrene of the intestine, thus fulfilling the double purpose of providing for the outlet of intestinal contents, and eliminating the source of septic absorption. It should add but very little to the length or shock of the operation. The operation will probably receive much more consideration in the future.

Artificial anus, 71 cases; 38 deaths; mortality, 53 per cent.

These cases represent a desperate condition, in which anything but the most simple efficient operation is poor judgment. It is good surgery in treating gangrenous hernia, which is, so to speak, situated outside of the body cavity, just as it is poor surgery to do it in gangrene of the intestine remaining within the peritoneal cavity; but, unfortunately, its efficiency in hernia has often been misunderstood, and applied in the abdomen with the most unfortunate results.

Whether the operation should be performed in one or two stages is a question for the individual operator to answer only in a given case. For hernia, there is, on the whole, little to be gained by waiting and much to lose.

The surgeon must bear in mind that when he makes an opening into the intestine, he must face the responsibility of its future closure. Nature occasionally comes to his assistance, but such a fortunate result is exceptional. Minor measures seem usually to be pretty unsuccessful, and efficient major operations, such as a formal liberation and resection of the fistulous intestine, are attended with a considerable mortality, twelve of the fifty-three fatal cases of artificial anus (with or without resection) are the results of such secondary resections, that is, it has a mortality of 27 per cent.! and this item raises the total mortality of artificial anus by 12 per cent.

Invagination.—Twenty cases; 3 died; mortality, 14 per cent.

This method may be taken as expressive of two procedures: (1) the turning in of a small gangrenous spot or perforation with a suitable form of peritoneal suture; (2) in somewhat more extensive, but still quite limited, areas of gangrene, by actually producing an artificial intussusception, depressing the necrotic area into the lumen of the gut, and fixing it in place by suture, so as to resemble the entry of the intussusception into the sheath.

While the above method may occasionally be applicable in very limited patches, it has a decided element of uncertainty, and really brings to a favorable case greater elements of danger than would be produced by treatment along ordinary lines. Moreover, it has the disadvantage of being a mode of treatment that fails to accord with the pathology; for, in the great majority of cases, the necrotic process is of uneven extent in the planes of the intestinal wall, being *least* on the peritoneal surface, more in the muscular wall, and *most* extensive in the mucous membrane.

If the method is to be applied at all, the loop of bowel should be isolated with packing, and not returned into the general abdominal cavity till the viability of the gut is demonstrated. With this added precaution, its field of usefulness is considerably extended, though it can never compete with more radical and better measures.

Entero-anastomosis.—Four cases, 3 deaths.

The indications for the performance of this operation must be very limited. Of several methods in which it may be applied, its chief sphere of usefulness will be on one of the following conditions:

(*a*) Strangulation of intestine, doubt of its viability. An entero-anastomosis may be made between the sound ends of the involved loop, the latter being isolated for further consideration, and ultimately receiving the treatment appropriate to its condition. Such a course has the advantage of providing for the uninterrupted normal course of the intestinal contents, no matter what the outcome of the condition of the gut.

(*b*) Resection of gangrene, artificial anus of ends. An anastomosis as described above may be added, providing in the same way for a continued flow of intestinal contents. Such a method would do away with the discomfort and danger (inanition) of an ordinary artificial anus, and facilitate the closure of the opening by some of the simple expedients that have recently been recommended for such cases. Its application, however, must be very infrequent, and its advantages over primary enterorrhaphy are not manifest.

PART III. GENERAL CONSIDERATIONS.

ANALYSIS OF THREE HUNDRED RESECTIONS AND PRIMARY ENTERORRHAPHY.

Intestinal obstruction, 74 cases; died, 55; mortality, 74 per cent. Hernia, 226 cases; died, 58; mortality, 26 per cent. Total, 300 cases; died, 113; mortality, 38 per cent.

Data in regard to the technical details of resection are available in 289 cases.

TABLE X.

	By Suture.	By Mechanical Means.
Perfect result; patient cured	111	59
Perfect result; patient died, but autopsy showed irreproachable condition	22	13
Died; no index to condition	34	13
Patient cured, but fistula requiring further operation.	2	...
Patient cured; fistula not requiring further operation.	7	1
Patient died; insufficient removal	7	5
Patient died; imperfection in method	10	1
Artificial anus made after resection	2	1
Death from use of faulty apparatus	...	1
	195	94

Operations by suture, 195; died, 75; mortality, 38 per cent.

Operations by mechanical aids, 94; died, 34; mortality, 36 per cent.

Of these mechanical aids, the Murphy button was used in seventy-six cases, viz.:

Intestinal obstruction, 13 cases; died, 9; mortality, 70 per cent. Hernia, 63 cases; died, 14; mortality, 22 per cent. Total, 76 cases; died, 23; mortality, 30 per cent.

The results as seen in Table X do not show very much improvement, from the use of mechanical aids, in general,—Murphy's button, plates, rings, bobbins, etc.,—over ordinary enterorrhaphy. They do, however, show some superiority for one method, the Murphy button. By the use of this device, resection for intestinal obstruction is lowered 4 per cent. to 70 per cent., and hernia by the same figure to 22 per cent. These differences alone are too small to have any importance; statistical variations to have any weight must be much more marked. By figuring up the data of the first two headings in the table, as compared with the total number by either method, one gets a probably well founded impression that, from the stand-point of technical success, that mechanical devices yield more perfect results; that is, we find 68 per cent. of such results with enterorrhaphy and 77 per cent. with mechanical aids.

The writer believes that this apparently narrow margin between the results of the two methods must be further analyzed. He believes, notwithstanding his personal preference for the application of the suture method, whenever good judgment permits its use, that the difference in favor of mechanical means—really the Murphy button—is actually much more marked, and the following are some of his reasons:

(1) Since the introduction of an efficient mechanical device, the Murphy button, the field of enterorrhaphy (by suture) has generally been restricted to the more favorable cases, even in the hands of surgeons of great skill and experience with the suture methods. This statement is believed to be a fair one, when it is remembered how wide-spread is its use. That there have been many opponents to its employment is true; it is also true that the converts to its use now far outnumber its opponents. Some of the early opposition was of a nature to make amusing reading in later days. As an example, the reader is referred to the solemn warning of König,[14] in 1895, in which he belittles the value of the button as a saving of

time, saying that in his own experience he never lost a case of intestinal resection from shock, and regretting that by its use the operation might be attempted by unskilled operators.

(2) In unskilled and inexperienced hands, the use of the Murphy button will yield better results both as to saving of life and the obtaining of complete success without fistulæ.

(3) The use of the Murphy button extends the field of resection. This statement depends to a large extent on the truth of the foregoing. Skilled and unskilled will frequently use it, when, if it did not exist, preference would be given to the establishment of an artificial anus rather than to a time-consuming enterorrhaphy. And therefore this procedure is a step nearer to the ideal of intestinal surgery, in which an artificial anus can never be a part. This latter operation is not only attended with great discomfort to the patient, but brings of itself three dangers, which cannot be disregarded. Danger to life from inanition if made high up in the alimentary canal, likewise danger from the procedures necessary to close it. There is also a considerable danger from wound infection, with or without a directly fatal result.

Death from Insufficient Removal of Gangrenous Bowel, Twelve Cases.—It goes without saying that this is a serious error; it is not a "legitimate" mishap, as it is usually quite preventable. Enormous amounts can be exsected without seriously impairing the sustenance of life. An instance of this fact is a case reported by Rocci and Fantino[13] of successful resection of 310 centimetres of the small intestine, terminating seven centimetres above the ileocæcal valve. The patient's condition was followed with great care, and the report contains much of interest on this subject. It was found that the ingested food was more quickly passed; the stools were more frequent, more watery, and richer in fat and carbonic acid. The patient, however, did well, and gained slightly in weight· this result being probably due to over-feeding. In these statistics there were fifteen resections of 100 or more centimetres. Cured, 310, 186, 141, 135, 127, 125; died, 466, 365, 250, 225, 150, 126, 111, 100 (two).[1]

---

[1] For special literature on this subject, see Kukula.

If the surgeon bears the above facts in mind, he will not hesitate at making a resection with a generous margin of sound tissue. Such a procedure is all the more imperative, for, as has already been said, the surface limitations of the intestinal damage are generally misleading; the muscular coat being more implicated than the peritoneal, and the mucous membrane more than the muscular.

In addition to the question of the vitality of the gut from pathological processes, there arises that of the necrosis of the wound surfaces in the suture line in end-to-end anastomosis, which, although uncommon, does occur. If it were observed only in resections for inflamed or necrotic intestine, the blame might be placed entirely upon the insufficient removal; but it is seen, though less frequently, in exsections for tumor, stenosis, etc., so that it is of itself a real danger, from the lack of anastomoses of the intestinal vessels. To remedy this trouble, it has been proposed to divide the bowel obliquely, forming an angle whose apex is located at the mesentery.

To do away with the danger of necrosis of the suture line, as well as the technical obstacles to getting a perfect approximation in end-to-end anastomosis, especially the closure at the mesenteric border, and when dealing with segments of uneven calibre, many resort to what is variously termed entero-anastomosis or lateral anastomosis; although the former term should perhaps be limited to communications established between different parts of the intestine without exsection of the intervening portion.

These observations on resection contain notes of twelve cases, in which it was clearly established that the amount of gut removed was too small; and doubtless more could have been added if post-mortem records had been available. It seems particularly important to secure a healthy margin in the proximal segment, where the results of insufficient exsection are usually most obvious.

Imperfections of method consisted for the most part in defects of the technique of suture and approximation, these being clearly differentiated from the mishaps due to necrosis of the suture line or insufficient removal of damaged gut. Another fatality was due to imperfect hæmostasis of the mesentery. These eleven mishaps, alone sufficient to prevent saving of life, could probably be much increased with complete revelation of facts. Occurring in eleven out of 113 resections, they represent, therefore, at least 10 per cent. of the sources of mortality following resection, a fact which should be emphasized, as it is a hint in regard to the possible reduction of mortality by perfection of operative details.

It may be noted that of ten patients who lived and had fistulæ, a spontaneous cure was obtained in eight cases, a point to be considered when estimating the prognosis of that condition.

Taking the three classes of cases attended with mishaps to the restoration of the continuity, insufficient removal of gut, perforation of the suture line from imperfection of suture with fatal results, and the cases of cure complicated by fistulæ, we find thirty-three cases out of the 253 cases of which data are available, making 13 per cent. of resections that are likely to be imperfect and a source of danger. This estimate is entirely too small, because, in the deaths with details unknown, the proportion is probably much higher; but at all events it is sufficiently high to indicate the necessity of providing against the accidents following such perforation.

Various Methods of Resection and Reunion.—The great majority of the resections were performed by end-to-end anastomosis, whether by suture or by the Murphy button.

Of the end-to-end anastomoses performed by other methods may be mentioned, three by Ullmann's turnip, Ball's decalcified ring, Villard's button, all cured.

There were five atypical resections of the invaginated bowel by the methods known variously as Barker's, Rydygier's, and Maunsell's modified method.

It seems rather remarkable that the typical Maunsell method, which is easy, rapid, and certain, is not oftener used in intestinal resection for acute conditions. It competes strongly with the Murphy button in saving of time.

Resection and reunion of intestines by lateral anastomosis:

By suture, eight cases, four died.

By apparatus, seven cases, two with potato plates, both cured; Senn's plates, one (died); rubber rings, three (one died); catgut rings, one (died). Total by lateral anastomosis, fifteen; died, seven.

These operations do not furnish any material for particular comment, as the number of cases does not warrant an attempt to draw serious deductions from them. They were apparently technically successful, no mishaps being noted. Properly and carefully performed by suturing alone, the operation is perhaps freest from remote disadvantages of any.

There is, of course, some possibility of the inevitable contraction of the anastomotic opening reaching an alarming degree; but the danger is seldom extreme, especially as the custom now prevails of anticipating such a diminution by making a sufficiently long opening (up to four inches). Skilled operations sometimes complete an anastomosis quite quickly; it very rarely is performed under fifteen minutes, and usually takes about thirty minutes, and sometimes considerably longer.

Entero-anastomosis without resection, 13 cases.

This operation is one of the most useful in chronic surgery, but has a very limited application in acute obstruction, except as an addition to other measures. Used alone, it is only called for in conditions leaving the intestinal structures undamaged; and if the continuance of the obstruction does not necessarily lead to further changes (such a condition as is presented by an intussusception which is simply irreducible), and the intestine is not, and will not, become damaged. The field of its application is very limited, and it should be resorted to only after an accurate realization of the actual and possible conditions.

It may also be used without a combination of other procedures as a prophylactic measure, when there is a legitimate doubt of the condition of the bowel, uninterrupted passage of the contents through sound tissue being thereby guaranteed;

if done with a mechanical contrivance, it adds little to the time of operation, and little danger beyond what attends the introduction of the foreign body.

Combined with an artificial anus, as in gangrenous hernia, it has the advantages just described. It also does away more or less completely with the discomforts of an artificial anus, and it favors and simplifies the subsequent closure of the opening either by natural processes or by operation.

The operation was performed as follows:

By suture, 10 times; 7 died. By apparatus, 3 times; 2 died. Total, 13; died, 9. Mortality, 70 per cent.

The apparatus was, cartilage plates, catgut rings, and Murphy's button. In one case two anastomoses were made, one with the button and one with suture.

The mortality shows that the operation was usually performed injudiciously and in improper cases.

Suture Material.—The use of silk in all forms of intestinal suture was wide-spread. It has no obvious disadvantages; its presence in the intestinal tissues creates no reaction; it is permanent, and therefore reliable, easily obtained and prepared, and can be kept ready threaded and quickly available for use.

Catgut is noted as having been used in fourteen cases. It must be acknowledged that these cases show no evidence of bad results from it.

The fate of the various mechanical devices: The Murphy button is the only one providing sufficient material for observation. It furnished two fatalities,—one by kinking of the intestine from the weight of the button; in another, by becoming blocked by a chunk of meat. There is no record of any disaster caused by the separation of the button, or by its presence after liberation. Notes on the time of passing of the button are incomplete (forty-five cases); in some instances it was not found at the autopsy, although believed not to have been passed during life.

The average time of passage of the button was twenty days. In four recoveries, the button was not seen. The longest period was 104 days; the shortest, six days.

Most operators seemed to prefer reinforcing the button with Lembert sutures.

RESULTS OF ARTIFICIAL ANUS.

For intestinal obstruction, 89 cases; died, 69; mortality, 79 per cent. For hernia, 101 cases; died, 53; mortality, 52 per cent. Total, 190 cases; died, 122; mortality, 64 per cent.

The results obtained are in accordance with the theoretical limitations of the use of artificial anus.

(1) To give exit to internal obstructions.

(2) To give an outlet to the intestinal contents at a point above a site of constriction, provided that thereby all indications of treatment are fulfilled, that is, the site of constriction does not necessarily require interference, no sepsis existing or likely to develop, or, if present, is provided with treatment destined to remove or limit the focus of absorption, *i.e.*, exsection of the intestine, or treating it extraperitoneally as in an external hernia.

For these reasons, the mortality of artificial anus is lowest in obstruction by foreign body, and highest in obstruction by an unyielding constriction, such as a band, and lower in hernia than in intestinal obstruction, because the surface exposed to absorption is less.

The chief reasons for a high mortality in artificial anus are (1) the class of cases. There is frequently no choice other than this operation; the patient is moribund; no general anæsthesia is possible; hit or miss, an artificial anus is made; if it fortunately happens to be above the constriction, the death agony is alleviated, and the friends feel that at all events some effort at relief has been made.

(2) Failure to go above the point of obstruction. This result generally follows on the above, the patient's condition not permitting of a systematic exploration.

(3) Failure to provide for the relief of absorption from gangrenous intestine. In such conditions the relief of the obstruction is only the relief of a symptom, and death from septic

absorption follows just as surely as if the obstruction were unrelieved. This error the writer believes to be the all-important feature in the question of making an artificial anus: it is due partly to an inability to effect the desired purpose, partly to timidity or hesitation on the part of the operator, and in most cases to failure to realize the necessity of making provision for the relief of the condition. This failure the writer also believes to be partly due to lack of discrimination between the conditions presented by internal strangulation with gangrene and gangrenous hernia. In the latter condition the indications for creating an artificial anus being considerably greater.

Artificial anus is the operation of choice when the patient's condition plainly forbids an ideal restoration to the normal, and it entirely relieves the obstruction, no conditions directly threatening life remaining.

An attempt is made below to classify the results of artificial anus; these are somewhat arbitrary, as the writer has frequently had to estimate them for himself, owing to the meagre descriptions of the cases. The results are compared, first, as to the causes of death and, second, as to the after results of artificial anus. (This second group, with the exception of fifteen cases, is made up entirely of hernia cases.)

TABLE XI.

CAUSES OF DEATH AFTER ARTIFICIAL ANUS.

Shock	37
Pre-existing peritonitis	16
Sepsis	6
Failure to go above site of obstruction	15
Exhaustion	8
Failure to resect gangrene	10
Result of subsequent operations	16
Fistula situated too high up for preservation of life	2
Causes independent of obstruction	9
Deficient technique	3

AFTER RESULTS OF ARTIFICIAL ANUS.

(*a*) Resection for artificial anus after intestinal obstruction, 7 cases; died, 3; mortality, 43 per cent. After hernia, 41 cases; died, 11; mortality, 27 per cent. Total, 48 cases; died, 14; mortality, 30 per cent.

(*b*) Entero-anastomosis without resection, 2 cases; 1 died.

(*c*) Successful closure by minor or plastic operations, 13 times.

(*d*) Fistula closed by means of the enterotome, four times, one death.

(*e*) Fistula closed spontaneously, sixteen times.

(*a*) If those statistics should be reproached for showing an over-favorable result for primary resection, the same cannot be said for secondary enterectomy, which, so far as regards hernia, seems to have a mortality practically equivalent to that of the primary operation. It is, however, the writer's belief that this mortality must be taken seriously, and that, if seemingly exaggerated, it is not inordinately so. Every operator of experience knows how extremely difficult is a secondary enterectomy with the intestine buried and fixed in dense adhesions, the tediousness of the operation, and the liability of injuring the intestine.

Furthermore, it must be remembered that a not inconsiderable proportion of such resections is necessarily done soon after the opening is made, on account of the danger to nutrition due to the high situation, and at a time when the patient has not fully regained his strength. Twenty-one of these resections are recorded as having been done in the two weeks following operation, viz., second day, 5 cases; died, 4; third day, 4 cases; died, 2; fifth day, 3 cases; died, 0; seventh day, 2 cases; died, 0; ninth day, 1 case; died, 1; tenth day, 2 cases; died, 2; eleventh day, 1 case; died, 1; thirteenth day, 1 case; died, 1; fourteenth day, 2 cases; died, 1. Mortality, 57 per cent.

TABLE XII.

METHODS USED TO PERFORM SECONDARY RESECTION.

	By Suture.	Died.	By Murphy Button.	Died.	By Other Methods.	Died.
End to end.	27	8	11	3	Paul's bone tube, 1	..
Lateral	2	2	..	..	Senn's plates, ..2	2
					Robson's button, 1	..
	29	10	11	3		
Mortality.	34 per cent.		27 per cent.			

These last figures are rather small, but they correspond pretty well to the results obtained in the large table of resections, a slight advantage being found on the side of the Murphy button.

The operator should bear in mind the consequences of an artificial anus and the difficulty of its repair, and should, when feasible, leave his opening or openings in the condition most favorable to repair. Among other means, he may do a "prophylactic" entero-anastomosis in addition to the artificial anus, or effect an apposition of the cut ends in gun-barrel fashion, making a subsequent anastomosis through the septum thus formed, and more easily close the ends.

(*c*) A cure by plastic operation does occur usually after some form of wedge excision combined with a Heineke-Mikulicz transverse suture. Sometimes simple refreshing and approximation or inversion of the margins suffices. Many, if not most, of the recorded resections were the sequel of failures of such plastics. So long as the intestine remains fixed, it is hard to keep the sutures in place; freeing the gut is almost a necessity.

(*d*) Spontaneous healing occurs usually only after months, seldom less than three; if it does not close within a year, it must be looked upon as incurable.

(*e*) The use of the enterotome can scarcely be discussed in modern times.

TABLE XIII.

ANALYSIS OF THE CAUSES OF DEATH IN ONE THOUSAND OPERATIONS FOR INTESTINAL OBSTRUCTION AND GANGRENOUS HERNIA.[1]

A	1.	Shock, so stated definitely	102	
		Shock, most natural presumption	65	
				167
	2.	Peritonitis, pre-existing	37	
		Peritonitis, pre-existing or subsequent	27	
				64
		Sepsis		9
	3.	Pneumonia, in all probability septic		18
		Operation abandoned or hopelessly incomplete		3
		Death on table,		14
		Exhaustion		6
				281
	4.	Intestinal toxaemia		1
	5.	Intestinal paralysis.		8
B	6.	Failure to relieve obstruction		48
	7.	Returning of bowel, subsequently becoming gangrenous		14
	8.	Rupture of bowel, failure to resect sufficiently		12
	9.	Defect on technique of resection		11
		Defect on technique of artificial anus		2
	10.	Peritonitis from application of enterotome		1
	11.	Septic peritonitis directly due to operation		2
	12.	Complications due to the use of mechanical aid to resection		2
	13.	Repair of artificial anus		15
	14.	Leakage from Meckel's diverticulum		2
	15.	Inhalation of vomit		4
	16.	Recurrence of obstruction		5
				118
C		Various intercurrent conditions:		
		Epileptic seizure during operation		1
		Perforating ulcer of the duodenum		2
		Convulsions		1
		Pleurisy		1
		Diabetic coma		2
		Hæmoptysis		1
		Cardiac disease		1
		Pulmonary œdema		2
		Gangrene of gut at point distant from intervention		1
				12

The data contained in Table XIII have been given in detail in the hope that their critical study might furnish some indication as to the direction we can and ought to seek an improvement of results.

---

[1] In a few cases, more than one cause of death was tabulated.

In order to obtain a broad view of the situation, the details have been collated under three large groups:

(*A*) Mortality from circumstances inseparable or a common sequel to the pathological condition.

(*B*) Mortality in part dependent on the pathological condition, but to a greater extent on the *modus operandi.*

(*C*) Mortality from intercurrent conditions.

A. What improvement can be expected when the mortality depends on such conditions as shock, pre-existing peritonitis, and pneumonia?

The outlook is certainly unpromising; but even under these conditions the writer believes the future will give better results.

(1) Shock. Of course this term is very blind, and may be used as a disguise for conditions producing shock *per se.* Admitting necessarily that a large proportion of cases die from pure shock, let us consider how we can best combat it. Our chief reliance must be in prophylaxis and by anticipation of it. Prophylaxis, for the most part, will consist in giving the patient the benefit of the doubt and of an early operation. While the responsibility is generally in other hands than the surgeons, it is not invariably so. So long as a surgeon serenely watches a patient with fæcal vomiting for four or five days (as noted several times), or ingenuously writes, "The case now" (after prolonged observation) "being apparently hopeless, it was decided to do a laparotomy," there is certainly the hope of improvement of results, through betterment of professional standards. Improvement in regard to shock can also be obtained, the writer believes, by improved methods of operating by a better set of operators, that must in all probability develop with the march of progress, broader experience, and more thorough teaching of the future student. Shock is largely due to the length of an operation, and by that term the writer means the total length of an operation. This phrase opens up a very broad field, and one which the writer believes is but little appreciated. Everybody realizes its necessity in general, but the carrying out of it has been obscured by the concentration of effort to shorten a particular part of an operation,—*i.e.*,

an intestinal resection. The writer believes, however, that in the case of many operators this shortening of the particular time for a particular step, while of great, is but of secondary importance. As a particular instance, a case of gangrenous femoral hernia, herniotomy, laparotomy, resection, and end-to-end Czerny-Lembert suture; time of resection, fifteen minutes; *total time* of operation, seventy-three minutes. In performing abdominal section, the peritoneum is more quickly invaded by a large rather than by a small incision, and the source of trouble is sooner located and dealt with. Closure of the abdomen, while of great importance, must be done quickly; time must be saved at every step, and the *whole operation* planned and carried out on that basis.

In addition to the exercise of good judgment as to the nature of the operation which will give the best results, with a minimum of delay and shock, much can be done by attention to small details during and after the operation, such as free stimulation, saline enemata, and infusions, and the maintenance of the bodily heat.

(2) Peritonitis and sepsis; also a question of prophylaxis; operating before the vitality of the intestine is impaired. It may also be diminished by a more universal realization of the simple fact that gangrenous bowel left in or returned into the abdominal cavity necessarily produces a fatal result, no matter to what extent the obstruction—only a component indication for operation—is relieved.

What the future holds for us in the way of development of agencies destined to limit or offset septic intoxication, or to increase the resistance of the human tissues to such absorption, cannot be foreseen. The results already obtained by certain "antitoxins" justify efforts in the search of such adjuvants (or correctives) of surgical art.

(3) All sick persons are liable to contract pneumonia, and none more so than the class of persons under consideration. We may therefore resign ourselves to a certain proportion of such deaths. It must be understood, however, that most of the pneumonias are septic; and it is an established fact that, as a

result of a strangulated hernia, a septic pneumonia may be set up without any peritonitis. Diminution of the sources and limitation of the absorption should lower the proportion of pneumonias. A number of these pneumonic processes are inhalation ("schluck pneumonie") pneumonias, the result of vomiting. Lavage of the stomach as a preliminary to operation will be a prophylactic measure. Pneumonia, as the probably direct result of the administration of anæsthetics, cannot always very well be avoided; but we may at all events be careful to limit the time of anæsthesia and the amount used.

(4) Intestinal toxæmia and paralysis. Relief of obstruction does not necessarily relieve or prevent these complications. Prompt evacuation of the bowels, either by incision and irrigation at the time of operation, or by therapeutic stimuli, will somewhat diminish this mortality. The term is, however, usually used as a mask for peritonitis.

(5) For nearly all the elements of this group we find a reasonable hope of some improvement, even if it can never be possible for human methods materially to influence it.

B. The Conditions Pertaining to the Operation.—This is the direction that extends greater possibilities of betterment of results, and its attainment must be sought for with the greatest earnestness.

(6) Failure to relieve obstruction. A certain proportion of such cases must be considered as inevitable, the patient's condition not allowing of proper search. The number, however, can be diminished if the operator never deviates from the principle that the obstruction *must* be relieved. A certain number of bad results of artificial anus made by groping in the dark can be diminished. And still more so when the abdomen is opened freely, if the operator will not desist until he has found not only an obstruction, but all obstructions. He will find it wise to bear in mind the tendency of certain forms of obstruction to act in combination with others or to be multiple (bands).

(7) The returning of bowel, subsequently becoming gangrenous; an entirely preventable cause of death. In sus-

picious cases, the bowel can be treated extraperitoneally (Hahn's method).

(8) Rupture of bowel can be prevented by realizing that resection is necessary, by making a sufficiently generous resection; its consequences may at all events be foreseen and minimized by the extraperitoneal treatment.

(9) Defects in technique of resection and artificial anus (thirteen cases). Improvements in this direction are certainly in order. The operator must make use of such methods as not only give the best results, but also which he individually can perform to the best advantage. Again, in doubtful cases, temporary extraperitoneal treatment is in order.

(10) Peritonitis from the use of the enterotome. It is wisest to forget that such an operation ever existed.

(11 and 12) Avoidable accidents, which, however, are of a class that must be considered to occur in a certain number of cases.

(13) Repair of artificial anus necessarily attended with a certain mortality; a difficult and dangerous operation; improvement may be obtained by prophylaxis, operating on cases before they need such treatment, and doing a primary enterorrhaphy whenever feasible; also by a more thoughtful study of the advantages of the various methods of repair, possibly also by anticipating repair to some extent by the addition of an entero-anastomosis at the time of making an artificial anus.

(14) Leakage from Meckel's diverticulum. The accident can be avoided by the possession of knowledge of the condition and its possible consequences.

(15) Inhalation of vomit; already referred to under pneumonia.

(16) Recurrence of obstruction; prophylaxis by endeavoring to provide against it in the conditions which most frequently give rise to it (intussusception, volvulus).

The above represents a group of 118 cases. It is fair to presume a not inconsiderable proportion of these deaths might have been averted by human means under favoring circumstances. They may be considered as avoidable accidents. A study of their nature must be instructive, and it is hoped of value.

C. Intercurrent conditions are beyond the control of the surgeon. This group of cases has been calculated in the general mortality, as there were no accurate data on which to estimate the actual or probable result of the operation. Conversely, certain cases dying of intercurrent conditions after a reasonable interval following operation have been put down as cures, because the autopsy (in each case) has demonstrated the absence of directly unfavorable sequelæ to the operation.

A word is perhaps in place here about seven cases of pregnancy.

One gangrenous hernia with volvulus resection; died of sepsis in seventeen days; pregnant, six months; aborted.

One volvulus, resection; died in three days; pregnant, five months; aborted (?).

One hernia, resection, Murphy button, cured; pregnant, seven months; aborted.

One hernia, resection, cured; pregnant, five months; aborted.

One femoral hernia, resection, cured; pregnant (?); aborted.

One umbilical hernia, resection; died first day; pregnant, seven months; aborted (?).

One volvulus, artificial anus; died; pregnant, three months; aborted (?).

Suggestions as to Operation.—Before beginning an operation, every possible contingency should be passed in review, and suitable measures provided for the proper handling of each one. It is especially important that every form of intestinal suture that may possibly be required should be in readiness. Much time is often lost by "bungling" on the part of assistants with the sutures at a critical period of the operation.

If there is vomiting, preliminary lavage of the stomach will diminish the difficulties of anæsthesia and remove a source of danger.

A large incision should be made from the outset, and enlarged so soon as it appears that an intra-abdominal exploration can be more easily and quickly accomplished by it. If the probable cause of obstruction has been previously diagnosticated, the presumptive knowledge of the condition will direct the surgeon's attention to the necessity of investigating certain regions first; in gall-stones, foreign bodies, and Meckel's diverticulum, more particularly the lower ileum; for volvulus the sigmoid, for intussusception the cæcum and colon. Investigation of the cæcum will indicate the general direction of the search; if dilated, there is obstruction of the large intestine; if collapsed, the hinderance is confined to the small intestine. The operator who finds "everything dilated" should at once examine the pelvis for the carcinoma or stricture, which might have been discovered by rectal examination had one been made.

The Advisability of Evisceration for the Purposes of Exploration.—Are the advantages, so far as saving of time, sufficient to counterbalance the disadvantageous elements added to the operation by this step? A great part of the time consumed in operations for intestinal obstruction is spent in locating the lesion; a great many failures to give relief are due to inability to locate the obstruction, and in some cases to find *all* of the offending causes. If one realizes that the cause of obstruction *must* be found, and the quicker the better, and it is not at once evident by an ordinary fair-sized incision, it is far wisest to act radically,—make a sufficient incision, and remove the package of small intestines on the surface of the body. This step determines a condition of shock from a threefold cause,—loss of body heat, circulatory disturbances, and, most important, peritoneal reflexes. The loss of heat may to some extent be offset by assiduous application and renewal of hot moist cloths. The reflexes from peritoneal irritation depend upon the integrity of the peritoneum, increasing with the degree of inflammation present, and the extent of handling of the intestines. There is apparently less shock from lifting up the intestines *en masse* than by pulling on them piecemeal. Tixier [22] found that when the peritoneum is healthy, the reflexes do not appear for ten to fifteen minutes following evisceration, "period of indifference;" but when inflamed, the reflexes appear at once. This statement appears to correspond with clinical experience, and serves as an indication for the limitations of evisceration. Its chief service is rendered in the search for the obstruction; this object having been attained, and in all probability with celerity, the operative field can be limited, and the bulk of the intestine can be returned. A portion of the abdominal wound may first be sutured for that purpose.

Incision of the Intestine for Evacuation.—While the opening of the intestine for evacuation may be necessary for exploration, it is to be avoided if possible, unless the conditions allow of proper management of this added complication during the rest of the operation. Should it be deemed wise to open the intestine to give relief from further absorption, even after successful removal of the obstruction, and to forestall paralysis, it should preferably be postponed till the close of the operation.

The field of operation having been located, the surgeon's care and resourcefulness in shutting off the rest of the cavity by suitable measures will contribute largely to the prophylaxis of sepsis. If a resection is necessary, it should be performed, so far as feasible, outside of the belly proper; the abdominal cavity being partially closed by sutures or protected by gauze or sponges.

Should it be thought wise to observe a suspicious loop of gut, a resection, or other intestinal condition capable of giving rise to trouble, a suitable portion of the wound may be closed; in the remainder, the loop of intestine in question is exposed, and is completely surrounded (except its anterior aspect) by appropriately disposed gauze packing. Sutures are inserted through all the layers of the abdominal wall, but not tied, unless provisionally to effect some approximation of the walls. Later, say forty-eight hours, under partial or primary anæsthesia, the gauze may be removed, and the bowel returned.

and the abdomen closed, entirely or to the extent that seems judicious.

Closure of the abdominal wound. When the patient's condition allows of the expenditure of time, the closure of the abdomen should be a matter of painstaking detail. When time is lacking, it may be quickly accomplished by arming a thread at either end with a long straight needle: the sutures are passed on either side from within outward, and if deftly handled, this method is the quickest, if one of the oldest. A curved needle on a handle (Peaslee, Reverdin) transfixing all the abdominal layers of both sides of the incision is the next quickest method, and one of the best for routine use in securing approximation of the muscular-fascial layer.

The general practice, to-day, usually seeks to obtain early and free movement of the bowels after abdominal section. Its value is especially recognized in checking or preventing inflammatory exudation. McCosh has demonstrated its great value in the presence of severe and extensive peritonitis. His success is undoubtedly due to the radical manner in which catharsis is secured. With an exploring syringe, a saturated solution (two ounces) of magnesium sulphate is thrown directly into the bowel during the operation, the puncture being closed with a stitch. Soon after operation the patient receives calomel by mouth. The writer would most warmly recommend this method in all operations for intestinal obstruction in which it seems wise or urgent to secure immediate catharsis. Naturally, in certain cases, threatening perforation, resections, etc., catharsis will generally be deferred till some days after operation.

Anæsthesia.—The data are meagre and furnish no conclusions as regards the comparative merits of the several forms employed.

Chloroform, 180 cases; died, 73. Ether, 72 cases; died, 32. A. C. E. mixture, 12 cases; died, 2. Chloroform followed by ether, 16 cases; died, 9. Local anæsthesia, 11 cases; died, 3. No anæsthetic, 5 cases; died, 3.

Prognosis of Operations for the Relief of Intestinal Ob-

struction.—The prognosis depends chiefly on the following conditions, in the order of their importance:

(1) The duration of the obstruction.

(2) The extent and severity of the changes in the intestine.

(3) The nature of the obstruction, whether internal or external; for the latter, how unyielding the nature of the constriction and the ease or difficulty with which it can be relieved.

(4) The promptness, good judgment, thoroughness, and skill of the surgeon.

(5) The patient's general condition.

The above points have been pretty thoroughly reviewed in the various portions of this article, and need perhaps no additional comment. Attention, however, is directed to Table IV giving the mortality by days. So long as we are dealing with large figures, the results are very significant and consistent. The percentages cannot be worked out very satisfactorily beyond that point, because, in dealing with a few cases, the fluctuations are necessarily vague and worthless. Tables VII and IX may be studied with particular advantages, as they represent single groups of conditions (intussusception, hernia) with a large number of cases. It is particularly significant that on the first day eleven resections for gangrenous hernia could be performed with a mortality of zero.

It is perhaps unusual to introduce the personal element of the surgeon as a factor in the prognosis. The careful detailed study of this extensive material has, however, impressed the writer that it is an element that deserves special recognition. The possession of "good surgical judgment" is very essential; mere manual dexterity is useless unless based on this quality, which latter depends much on the personal characteristics of the individual.

SUMMARY.

Intestinal Obstruction.—The most frequent causes of intestinal obstruction are intussusception and bands.

The mortality is 47 per cent.

The mortality of resection is 74 per cent.

The mortality of artificial anus is 77 per cent.

The mortality depends on the duration of the obstruction and on its nature being least in foreign bodies, inflicting little or no damage to the intestine (25 per cent.), and most in such conditions as produce a tight constriction as "openings" (67 per cent.).

Hernia.—The mortality is 34 per cent.

The mortality in males is as one is to two.

The proportion of femoral herniæ is 59 per cent.

The ratio of mortality of inguinal herniæ to femoral is as three is to four.

The mortality of resection and primary enterorrhaphy is 26 per cent.

The mortality of artificial anus is 53 per cent.

In General.—Resection and primary reunion by suture, mortality, 38 per cent.

Resection and primary reunion by apparatus (including Murphy button), mortality, 36 per cent.

Resection and primary reunion by Murphy button, mortality, 30 per cent.

A large proportion of deaths is due to failure of technique, such as removal of too little intestine, or imperfect suture. At least 13 per cent. of resections are attended with defects of technique either resulting fatally or in the formation of intestinal fistulæ.

Artificial Anus.—The mortality is lowest in internal obstruction, such as a foreign body, and highest in obstruction by an unyielding constriction, such as a band, and lower in hernia than in internal obstruction, chiefly because the surface exposed to absorption is less. The chief sources of mortality are:

The desperate character of the majority of the cases.

Failure to establish the opening *above* the site of constriction.

Failure to provide for the relief of absorption of gangrenous changes in the intestine; death often necessarily occurring on this account, although the obstruction is perfectly overcome.

Prominent among the drawbacks of artificial anus is the fact that it must subsequently be repaired. For in most cases there is no tendency to spontaneous closure, while minor plastic operations are rarely efficient. Formal liberation of the intestine and secondary resection is usually an exceedingly difficult operation, as is evident by its mortality,—

After intestinal obstruction, 43 per cent.; after gangrenous hernia, 27 per cent. Average, 30 per cent.

The causes of death after operation fall into three main groups:

(1) From causes inherent to the condition and little amenable to treatment,—such as shock and pre-existing peritonitis,—these causes accounting for the majority of fatalities. Improvement can only be hoped for by earlier recognition of the condition, thereby securing the performance of operative relief before the severer changes take place.

(2) From causes depending chiefly on the nature and details of the operation, such as failure to relieve obstruction and defects in technique, or failure to take account of the conditions to be dealt with.

(3) On intercurrent conditions.

Prognosis.—The most essential feature in the prognosis is the duration of the obstruction. In early interference there is generally only one condition to be fulfilled, removal of the obstruction. With long continuance of this condition, secondary changes of the greatest gravity supervene, requiring for their relief measures of great extent and difficulty.

The nature of the obstruction is the next most important factor, acting in the same way as in the first instance as to changes in the intestinal walls, the prognosis being best in internal obstruction, and worst in tight external constrictions.

BIBLIOGRAPHY.

[1] American Journal of the Medical Sciences, May, 1897.
[2] ANNALS OF SURGERY, Vol. xxvi, p. 353.
[3] ANNALS OF SURGERY, Vol. xxix.

[4] Archiv für klin. Chirurgie, Vol. xxxix, p. 173.

[5] Archiv für klin. Chirurgie, Vol. xl, p. 84.

[6] Archiv für klin. Chirurgie, Vol. xlviii.

[7] Archiv für klin. Chirurgie, Vol. liv, Heft 2.

[8] Archiv für klin. Chirurgie, Vol. lx, Heft 4.

[9] Berger: "Dix milles observations de hernies."

[10] Von Bergmann: St. Petersb. med. Wochenschrift, 1896, No. 44.

[11] British Medical Journal, 1896, Vol. i, p. 113.

[12] Brooklyn Medical Journal, 1897, p. 491.

[13] Centralblatt für Chirurgie, 1896, p. 614.

[14] Centralblatt für Chirurgie, 1895, p. 85.

[15] Centralblatt für Chirurgie, 1893, p. 62.

[16] Cf. article by the writer in Archives of Pædiatrics, February, 1900.

[17] Hahn: Deut. med. Wochenschrift, 1897, Nos. 41-43.

[18] Hinterstoissier: Wien. klin. Wochenschrift, 1895, p. 98.

[19] Hofmokol: Klinisch. Zeit. und Streitfragen, Band vi, Hefte 5 und 6.

[20] Journal de Médecine de Bordeau, 1892, p. 39.

[21] Lancet, 1891, Vol. i, p. 1312.

[22] "La pratique de l'evisceration en chirurgie abdominale," pp. 333, Paris, 1898.

[23] Lyon Medical, 1898, p. 215.

[24] Maydl: "Die Lehre von den Unterleibsbrüche," 1898.

[25] Maylaid: Glasgow Medical Journal, 1896, p. 143.

[26] Medical Record, July 17, 1897: "Mortality and Treatment of Acute Intussusception," by C. L. Gibson. This paper contained 239 laparotomies for acute intussusception, but only the cases operated on since 1887 (149 in number) were used as a basis of results of treatment. This series here recorded comprises thirty-eight additional cases published since 1897.

[27] Medico-Chirurgical Transactions, 1892-93, p. 197.

[28] Mittheil. aus der Grenzgebiet der Medicin und Chirurgie, Band ii, Hefte 2 und 3.

[29] Murphy: Deut. Zeitschrift für Chirurgie, Vol. xlv, p. 54.

[30] Schwarz et Rocard: Rev. de Chirurgie, 1892.

[31] Transactions of the London Clinical Society, Vol. xxvii, p. 205.

[32] Treves: "Intestinal Obstruction," 1899.

[33] Winiwarter: "Billroth Festschrift."